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TWELFTH ANNUAL MEETING

1936-1937

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HAWAIIAN ACADEMY OF SCIENCE

The Hawaiian Academy of Science was organized July 23, 1925, for "the promotion of research and the diffusion of knowledge."

The sessions of the Twelfth Annual Meeting were held in Dean Hall, University of Hawaii, December 3 and 4, 1936, and May 6 and 7, 1937, ending with a banquet at the Pacific Club on May 8.

OFFICERS

1936-1937

President, Harold A. Wadsworth
Vice-President, Walter Carter
Secretary-Treasurer, Mabel Slattery
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PROGRAM OF THE TWELFTH ANNUAL MEETING

THURSDAY, DECEMBER 3, 1936, 7:30 P. M.

Preliminary announcements.

Presentation of papers:

David T. Fullaway: The fruit fly parasite introduction project under the AAA and its results to date.

Nils P. Larsen, Jane Giles, and Olga Fulton: A study on one phase of human metabolism.

Edna C. Wentworth: Living standards of plantation Filipino families in Hawaii.

Charles S. Judd: Staghorn fern invasion. (Presentation by title only.)

Joseph E. Alicata: Trichinosis in Hawaii.

FRIDAY, DECEMBER 4, 1936, 7:30 P. M.

Preliminary announcements.

Amendments to constitution (page 26).

Election of members.

Presentation of papers:

C. E. Pemberton: Local quarantine against insects in view of clipper ship service.

Romanzo Adams: The Hawaiian census classifications of population before 1900.

Harold T. Stearns: Geologic history of the island of Lanai, Hawaii.

Edwin H. Bryan, Jr.: Plant associations on Guam.

Stanley S. Ballard and Paul L. Gow: An improved vacuum type tube for collecting volcanic gas.

THURSDAY, MAY 6, 1937, 7:30 P.M.

Preliminary announcements.

Appointment of committees.

Presentation of papers:

Edwin H. Bryan, Jr.: When the sun casts no shadow.

David T. Fullaway: On the genus Echthromorpha (Hymenoptera).

Thomas A. Jaggar: New model seismograph for Mauna Loa earthquakes.

F. R. Fosberg: An aggressive Lantana mutation.

Chester K. Wentworth: The Diamond Head black ash. (Presentation by title only.)

Thomas A. Jaggar: Trends in the philosophy of science.

FRIDAY, MAY 7, 1937, 7:30 P. M.

Preliminary announcements.

Presentation of papers:

Oscar C. Magistad: Some accomplishments arising from research financed by sugar processing taxes.

J. L. Collins and K. R. Kerns: Studies on the causes of seediness in the Cayenne pineapple.

Nils P. Larsen: Intestinal parasitism in Hawaii.

Stanley S. Ballard, Paul E. Chu, and Paul L. Gow: The use of the arc spectrum in qualitative analysis.

Elvin A. Hoy: An algebra of approximations.

Arnold K. Balls: Some modern aspects of enzyme catalysis.

SATURDAY, MAY 8, 1937, 6:30 P. M.

Pacific Club banquet.

Constitutional order of business.

Election of members.

Installation of officers.

Presidential address: Comparative irrigation institutions in Hawaii and in continental United States.

ABSTRACTS OF PAPERS

COMPARATIVE IRRIGATION INSTITUTIONS IN HAWAII AND IN CONTINENTAL UNITED STATES[1]

(Presidential Address)

By

H. A. WADSWORTH

Conceptions of water law in Hawaii and the irrigation institutions founded upon them differ as markedly from those in continental United States as the islands themselves differ from the less favored parts of the mainland. Under local conceptions, water is considered as real property, subject to all virtues and responsibility of ownership. In spite of all the confusion of water law in continental United States, one point stands clear —water is the property of the State and its use by individuals is restricted under strict license by the State.

Regardless of the social equity behind these two conceptions, it is clear that the irrigation organizations operating under them would be dissimilar; and indeed they are. In Hawaii, water has been developed and used by private enterprises; new enterprises have been financed from increased earnings of older ones. Never has the long arm of governmental subsidy aided in the costly works necessitated by difficult local topography.

Contrasted with this highly individualistic philosophy is the paternalistic aid for irrigation on the mainland. Such aid may not be overly apparent but is none the less real. At times great irrigation enterprises are governmental projects. Sometimes the credit of the State is extended to groups of landowners who desire the benefits of irrigation but lack the necessary capital. Sometimes States provide irrigation facilities on government land toward the end of subsequent resale to settlers at the cost of improvements.

It is recognized that different forces have been at work in the formation of irrigation institutions in these two widely separated parts of the United States.

In Hawaii, water became real property through a series of laws and decrees which are perhaps unique in history. In continental United States, water is considered a national resource to be administered by governmental agencies toward the end of national wealth and social equity. Under Hawaiian conditions, the local code has worked well with a minimum of water

[1]Address of retiring president of the Hawaiian Academy of Science, Annual Meeting, May 8, 1937.

litigation. The fact that such a code has, in large measure, escaped recognition must not detract from our appreciation of its soundness.

(This report has been published in full in The Hawaiian Planters' Record, Volume XLI, no. 3, 1937.)

THE FRUIT FLY PARASITE INTRODUCTION PROJECT UNDER THE AAA AND THE RESULTS TO DATE

By

D. T. FULLAWAY

A renewal of interest in the possibility of achieving a better control of fruit flies in Hawaii resulted from the generous disposition of part of the sugar processing tax monies collected under the AAA to uses calculated to benefit general agriculture in the islands. A biological control project, formulated by a committee of local entomologists and calling for additional and comprehensive investigation of the natural enemies of the fruit flies of the tropics, was presented to the Secretary of Agriculture, approved by him, and referred to the United States Bureau of Entomology and Plant Quarantine for execution. Working under the supervision of the Chief of the Division of Foreign Parasite Introductions, expeditions went to East and West Africa, South America, and the Far East or Oriental Region. As a preface to the account of the different parasites and predators found by the present expeditions, the development of the fruit fly problem in Hawaii is sketched, and previous efforts to control the ravages of the fly, particularly the efforts made to secure control by biological methods, are recounted. The problems presented by the necessity of transporting the useful insects found over long distances, propagating them to secure increase of numbers, and acclimatizing or establishing them in the face of a severe competition coming from the natural enemies already present in the islands are fully discussed; the probable outcome or result of the work and further possibilities are briefly stated.

A STUDY ON ONE PHASE OF HUMAN METABOLISM

By

NILS P. LARSEN, JANE GILES AND OLGA FULTON

The paper was a report on a continuation of studies made in Queen's Hospital laboratory on the possible effect of acid-base values in the diet. A review of certain work done in eastern laboratories was given, showing how body calcium can be effected by the ingestion of acid radicals; also a suggestion of its effect on Vitamin C. Total ammonia and total acid measurements were made on all the specimens of urine of two subjects of equal weight. One of the subjects had a natural tendency to a greater acid output and the other to a greater ammonia output in the urine. Vitamin C studies, as well as the acid-base studies, were made and a variation in the output of Vitamin C was shown. With the addition of Vitamin C to the diet a very marked rise in urine Vitamin C was shown. This rise did not occur in two ill patients in the hospital; the reason for this was shown. A marked rise after ingestion of guavas was also demonstrated. The results were given in a series of graphs.

These studies are continuing as part of the laboratory studies of the Queen's Hospital Research Department, whereas the field work is continuing on Ewa Plantation under the direction of Dr. Charles Wilbar. During the year, he has substituted guava juice in place of orange and lemon juice in the infant's diet. This has been very satisfactory.

LIVING STANDARDS OF FILIPINO PLANTATION FAMILIES

By

EDNA CLARK WENTWORTH

Under Institute of Pacific Relations auspices, a survey of incomes and expenditures of 101 Filipino families living on an Oahu sugar plantation was conducted in 1934. A combination of the account and questionnaire methods was used, each family being visited every other day for four weeks in order to secure the food records. Other items in the budget were recorded on questionnaires covering a year's expenditures ending during the summer of 1934. Records of medical treatment were secured from the plantation hospital, and plantation payrolls were examined to verify the earnings of the husbands.

Of the 101 families, 77 were Visayan and 24 Ilocano. They averaged 10 years' residence in the Territory. There were 575 persons in the households, all but 16 of whom are included in the records. Of the 341 children, only 21 were self-supporting. Seventy-six husbands were employed in the fields, 17 in the mill, and 8 in other work. Thirty-four of the 48 on long-term contract work received the "big pay" during the year covered.

Family income ranged from $243 to $1,492, averaging $683, plantation income of husbands amounting to $498. Cash received from the plantation amounted to less than 30 percent of the wages, the remainder being deducted to settle accounts handled through the office.

Perquisites provided by the plantation, including house, water, fuel, and medical service, were estimated at $210 per family. The 101 families averaged a deficit of $13 for the year. Total value of living averaged $1,014, of which $742 represented cash expenditures not including savings or payment of back debts.

Expenditures of Filipino families are unique and only slightly influenced by local customs. Diet was exorbitantly high in rice and low in fruits, vegetables, and fat. Expenditures were marked by relatively high amounts for street suits and hair oil for men, for yellow gold jewelry for women and girls, and for high electric light bills in some cases due to the desire to ward off evil spirits by burning lights all night. There were few chairs, and beds in only 71 percent of the homes, while every home had a sewing machine and half the homes had large framed pictures and cabinet type victrolas. There were baptismal ceremonies, which throw families in debt for several years, Saints' celebrations, funerals and their anniversaries, and gifts far beyond what would seem to a Westerner a reasonable relationship to other items in the budget.

(Illustrated with slides.)

STAGHORN FERN INVASION

By

CHARLES S. JUDD

Although the *uluhi* or staghorn fern (*Gleichenia linearis*) makes a fair cover for water conservation, it has two undesirable qualities. It invades the native forest with a dense mat which prevents natural reproduction, and in dry seasons this mat presents a serious fire menace.

To seek more information on the behavior of this fern, an experiment was undertaken at Waiahole, Oahu, on January 19, 1933, to determine six points, as follows:

1. The best method and tools to use for the complete clearing of staghorn fern. 2. The rate at which the fern may be cleared by human labor. 3. The effect of removing only the living fern. 4. The effect of leaving some of the fern in uncut windrows. 5. The rate at which fern encroachment takes place from the sides. 6. The occurrence of erosion on steep slopes after fern removal.

This experiment has now run for three and three-fourths years and the results to date are as follows:

1. It was found that the most feasible way to clear the fern was to start at the top of the hill and cut the fern with cane knives and roll it downhill, using prying sticks of forked guava.

2. The fern on a .71 acre plot was cleared in this manner by 15 men in a five hour day. At this rate one man can clear .047 acre in a day or one acre in 21 days. At a daily wage of $2.00, therefore, one acre of staghorn fern may be cleared for $42.00.

3. The effect of removing the living fern, generally speaking, discouraged its growth, and it did not renew itself except by creeping in from the sides. It has been replaced in parts with natural seedlings of *koa, naupaka,* lantana, guava, hala, horseweed, sedge, and with *mauu laiki* grass.

4. Leaving some of the fern in windrows resulted in its being discouraged somewhat but the fern in the bulk of the windrows has grown together and formed a solid mass.

5. To determine the rate of encroachment, ten stakes were placed at intervals at the edge of the original clearing and the edge of the advancing fern front was carefully measured from these stakes. It was found that the fern advanced uphill faster than downhill. After three and three-fourths years the greatest invasion was 26 feet and the least 11 feet from the stakes. This gives annual rate of invasion of 6.9 to 2.9 feet. The average rate of invasion on the whole cleared area has been 3.78 feet a year.

6. The heavy mat of dried fern stems and roots and a voluntary new cover of seedlings mentioned above (3) have prevented any sign of erosion on the steep cleared area.

TRICHINOSIS IN HAWAII

By

JOSEPH E. ALICATA

Trichinella spiralis, a parasite occurring in carnivorous mammals in many parts of the world, was recently discovered to be present in Hawaii. The finding was made April 16, 1936, in examining a sample of pork product made from "wild" hogs captured on the island of Hawaii. This product was submitted to the writer for examination by Dr. E. A. Fennel of Honolulu, and was believed to have produced symptoms of trichinosis in several individuals that had eaten it uncooked.

On April 27, 1936, Dr. W. N. Bergin of Hawaii reported to the Territorial Board of Health two cases of human trichinosis which he diagnosed from clinical symptoms. Later, May 6, 1936, he reported another human case based on clinical symptoms which was confirmed by Dr. E. A. Fennel by the finding of trichina larvae in the muscle of the patient. Recently (October 26, 1936) Dr. Fred Irwin of Olaa, Hawaii, reported to the writer two cases of human trichinosis which he diagnosed from clinical symptoms in January 1936.

Under the auspices of the Territorial Board of Health, a survey conducted on the island of Hawaii to determine the extent of trichinosis in various animals, revealed the parasite present in all districts of the island except Puna. The various animals examined and found infested with trichinae are as follows:

Kind of animal	Number examined	Number infested	Percentage
Rats (four species)	2,130	57	2.6
Mice (*Mus musculus*)	306	0	0
Mongoose (*Mungos birmanicus*)	70	17	24.2
Domesticated hogs (*Sus scrofa domestica*)	61	1	1.6
"Wild" hogs (domesticated hogs gone wild)	41	6	14.6

The results for each species of rat examined are as follows:

Species of rat	Number examined	Number infested	Percentage
Rattus norvegicus	820	39	4.7
Rattus rattus rattus	511	15	2.9
Rattus rattus alexandrinus	397	2	0.5
Rattus hawaiiensis	402	1	0.2

(Illustrated with lantern slides.)

LOCAL PLANT QUARANTINE AND THE PRESENT EMERGENCY ARISING THROUGH TRANS-PACIFIC AIRPLANE SERVICE

By

C. E. PEMBERTON

Dr. R. C. L. Perkins states in "Fauna Hawaiiensis" (1913) that a total of about 3,325 species of insects was known to him in the Hawaiian islands. Since then there have been many introductions, both intentional and as intruders. Of this large number, practically all which may be classed as pests are of foreign origin. Insects transported from one country to another will usually, under suitable ecological conditions, thrive better in a new environment than in their original habitats; hence the introduction of foreign insect pests must be rigidly guarded against. Our principal food crops are still free from many of the worst pests that attack them elsewhere.

The danger attending the introduction of foreign insect pests to Hawaii was recognized as early as 1890, when King Kalakaua issued orders providing for the seizure of insect infested plant material; and in 1892 the ruling was amplified to protect livestock. Quarantine measures were further strengthened between 1892 and 1900. Since then the plant quarantine service has been developed to a high state of efficiency and excellence, and is now considered by visiting entomologists and plant quarantine officials as equal to the best in the world.

With the inauguration in 1936 of trans-pacific airplane commerce between California and the Philippines, via Hawaii and other Pacific islands, a new emergency has arisen. Insect stowaways, aboard planes which traverse thousands of miles of ocean in a few days, can live without food and escape far from their home countries in good condition. Regular plant quarantine systems are entirely inadequate to cope with such a situation. Recent inspections of planes arriving in Pearl Harbor from the Philippines reveal the presence of many foreign insects, some of which are serious pests in Oriental regions. These can escape as soon as the planes are opened to discharge passengers and baggage. Preventive measures must be taken before the planes reach Honolulu.

In order to completely eliminate insects before the planes reach Hawaii from the pest-ridden tropics to the southwest, the Hawaiian Sugar Planters' Association has placed a skilled entomologist on the island of Midway for the sole purpose of thoroughly spraying and otherwise treating the interior of all planes during their overnight stop at the island. Clipper ships traveling both east and west are treated. This work is done with the full cooperation and approval of the Pan-American Airways and the United States

Naval and Public Health authorities. Planes arriving in Honolulu from the Philippines, via Guam, Wake Island, and Midway since this work began on November 24, 1936, have been singularly free from insects.

An elaborate survey of the insects of Guam by O. H. Swezey for the United States Naval authorities of that island and financed by the H.S.P.A., has been included as part of the present quarantine program, in order that a better understanding may be had of the insect species, both harmful and beneficial, that occur there.

THE HAWAIIAN CENSUS CLASSIFICATION OF POPULATION BEFORE 1900

By

ROMANZO ADAMS

We owe much to the various Ministers of Public Instruction who served as directors of the censuses, 1849-1896. On the whole their work was reasonably well done and the data are of great value. But they were not professional statisticians, and when one uses the data he must be on the lookout to discover the meaning of the classificatory terms as they were used—he must not read his own meaning into them or assume that they had a constant meaning throughout the half century.

1. The classificatory terms are never defined, but in nearly all cases one can infer the definition from an inspection of the tables.

2. The tendency was to avoid terms of a clear racial meaning. Such terms as "white" and "colored" or as "Caucasian" and "Mongolian" were never used.

3. But the terms "native" and "foreigner" were used as racial terms. A native was a member of the "native race" no matter where he was born. A foreigner was a member of some other race and he might be Hawaiian born of Hawaiian born parents, all of whom were citizens of the Republic or subjects of the Hawaiian ruler.

There was a pretty constant tendency to change the implied definitions of terms and this was sometimes done without obvious notice. In 1849, the mixed-blood part-Hawaiians were called "half-caste" if they were found in the homes of foreign fathers, and they were "foreigners" also. In 1853, all the mixed-bloods were "half-caste", and they were "natives". In 1860 and 1866, the full white Hawaiian born children of American and British residents were classified as foreigners and as American and British, but in 1872-1890 they were not included among the Americans and British, but in a special class—"Hawaiian born, both parents being foreigners". Ameri-

cans, British, and Chinese were all included without distinction of race. In 1884 and 1890, several hundred persons were called "Polynesians," but in 1896 they were "South Sea Islanders". In all censuses before 1900 the negroes and part-negroes born in the Cape Verde Islands were counted as Portuguese, but in 1900 they were classified as negroes so far as the information was available—probably about half of them were so classified. In 1890, the age class, one to six, included no persons who had reached the end of the sixth year, but in 1896 children six years of age and under seven were also included under this caption.

GEOLOGIC HISTORY OF THE ISLAND OF LANAI, HAWAII[2]

By

HAROLD T. STEARNS

Lanai consists of a single, partly eroded volcano built entirely of thin-bedded basalts which accumulated in the form of a dome. The sequence of events in the geologic history is summarized as follows:

LATE TERTIARY (?) TIME

1. Building of island over 3,800 feet high by basalt flows from northwest, southwest, and south rifts with the center of the activity at their intersection a little southwest of the present summit of Lanai. 2. Collapse along the south and northwest rifts and formation of a caldera at their intersection. 3. Diminished activity with most of the lava filling the downfaulted areas. Scattered eruptions on the southeast flank. Establishment of streams on the northeast side only.

EARLY (?) AND MIDDLE (?) PLEISTOCENE TIME

4. Cessation of volcanism. 5. Establishment of streams over entire island and formation of canyons on northeast slope. 6. Continued marine and stream erosion. 7. Gradual submergence of Lanai by at least 1,500 feet, resulting in the drowning of valleys. Continued erosion and growth of coral but not reefs. 8. Short halt and then gradual emergence. 9. Short halt after about 500 feet of emergence with development of a shore line at 560-foot altitude. (Possibly the emergence was somewhat more and then the island was resubmerged to an altitude of 560 feet.) 10. Emergence of about 850 feet and development of bench 300 feet below present sea level. 11. Sub-

[2] Published by permission of the Director, United States Geological Survey.

mergence of about 400 feet and depositing of marine sediments approximately 100 feet above present sea level. 12. Emergence of about 160 feet and formation of calcareous dunes on the northeast slope. Vigorous marine erosion on west and south coasts. 13. Submergence of about 85 feet partly drowning dunes at Lae Hi Point.

LATEST PLEISTOCENE OR RECENT TIME

14. Emergence of 25 feet to present shore line, continued erosion and sedimentation of ancient caldera. Introduction of livestock causing greatly accelerated wind and stream erosion, development of large denuded areas, formation of narrow plain along northeast coast, and annihilation of near shore fringing reef organisms along windward coast.

Possibly a halt in the emergence occurred at about five feet above present sea level.

PLANT ASSOCIATIONS OF GUAM

By

E. H. Bryan, Jr.

Guam is an island 30 miles long and from 4 to 9 miles wide located at the southern end of the Marianas group, south of Japan, between latitudes 13°15′ and 13°40′ N., and longitudes 144°37′ and 144°57′ E. The northern half of the island is composed of limestone—a great section of reef, raised at the northern end to a height of 400 to 600 feet, sloping gradually southward to a low, narrow isthmus. In this region there is one grassy, volcanic hill. The southern half consists of a ridge of hills of volcanic origin, the highest elevation being 1,334 feet. It is bordered on both sides by raised limestone. On the west, this forms the Orote Peninsula; on the east, a series of flat-topped bluffs. The west slope is short and steep; the east slope, broader, more gradual, and cut by several valleys, carved out by streams. Near the center of the range some hills are mantled with limestone.

The climate is tropical, modified by trade winds. The average temperature is about 81° F., varying but little. The humidity is high. The rainfall at Agana is about 90 inches a year; that of the north end, a little more; that of the south end, markedly less. The hills are not sufficiently high to cause pronounced local variation.

Five natural plant associations can be noted: strand, limestone forest, savanna, modified forest in volcanic soil valley bottoms, and swamp and water. About 58 percent of 545 species of ferns and flowering plants are thought

to have been introduced through the agency of man, including weeds, crops, and ornamental plants. About 31 percent are indigenous and 11 percent endemic. There are more than a hundred plants of American origin which probably reached Guam during two and a half centuries of yearly galleons from Mexico to Manila, 1571 to 1815. From 1815 to 1898 direct shipping with Manila gave opportunity for the importation of an equal number of introduced Malaysian species.

The strand plants are mainly species widespread in the Pacific and Indian oceans. The limestone regions, where not cleared for cultivation, are densely covered with moist forest. The heavy clay soil of the volcanic hills supports only a savanna of grass and herbs, dominated by swordgrass (*Miscanthus*). In the valleys of this region an open scrub forest develops.

AN IMPROVED VACUUM TYPE TUBE FOR COLLECTING VOLCANIC GAS

By

STANLEY S. BALLARD AND PAUL L. GOW

Volcanic gases were collected at Kilauea in 1912, 1917, 1918, and 1919 by Drs. A. L. Day, E. S. Shepherd, and T. A. Jaggar. The vacuum type gas collecting tubes used by them were not entirely satisfactory for two reasons. First, there was no sure way of breaking or melting the tips to allow gas to rush in at exactly the desired time. Second, after the collection was complete it was difficult to seal off the tubes without a certain amount of air leaking in and thus polluting the sample. It is hoped that in the tube being reported on, these two difficulties have been overcome. The new tube consists of an 800 cc. Pyrex glass Kjeldahl flask to the neck of which is joined one arm of a vacuum-ground stopcock. To the other arm of the stopcock is joined two to four feet of Pyrex glass tubing. The tubing is drawn out into a tip which can be broken off at the appropriate time by a wire, one end of which is fastened to the tip and the other end held in the collector's right hand, the tube being held in his left hand. The entire apparatus is originally pumped out to a rather high vacuum. When the tip is broken off, gas rushes into the evacuated bulb through the tubing. It is imprisoned there by shutting off the stopcock before the tip is withdrawn from the gas source. Thus air from the atmosphere is entirely excluded. One of these tubes was tested during the summer by collecting gas escaping from a vent in the Sulfur Banks near the Hawaiian Volcano Observatory. The tube performed entirely satisfactorily, so several more have been made and are ready for use in collecting the gas emanating from molten lava at the time of the next eruption.

WHEN THE SUN CASTS NO SHADOW

By

E. H. Bryan, Jr.

A knowledge of the yearly movement of the sun in latitude finds practical application in helping to explain insolation, the march of temperature, cycles of plant growth, and allied phenomena. It is also useful to architects and landscape gardeners, in the orientation of buildings, tennis courts and other athletic fields, the placing of solar heaters, and the laying out of gardens.

At any locality between the tropics the sun will pass through the zenith twice during a year, at which time a vertical object will cast no shadow. At Honolulu this occurs on about May 28 and July 17. At this time, maximum noon insolation is experienced. The total amount of insolation also depends upon the duration of sunlight or length of day, the distance of the earth from the sun, variability of the solar radiation, and local atmospheric conditions. It is a curious fact that on certain days, polar regions receive the highest daily insolation, but the equator has the greatest annual insolation as measured in thermal days. There is a lag in temperature due to secondary meteorological phenomena.

(Illustrated by charts showing the analemma, altitude and azimuth of the sun throughout the year as seen from Honolulu, and lines of equal percent of insolation at Honolulu during the year.)

ON THE GENUS ECHTHROMORPHA (HYMENOPTERA)

By

D. T. Fullaway

Echthromorpha is a genus of large-sized and often brightly colored parasitic wasps or ichneumon flies which has been the subject of much study. The genus is interesting from several points of view, particularly that of geographic distribution. It contains 27 described species and the range of distribution from Africa to the Australian continent and the Pacific islands, to Hawaii on the north and the Marquesas on the east, is quite extensive for such a homogeneous group.

Echthromorpha definitely links the Hawaiian fauna with those of other parts of Polynesia and indicates that there are older connections with the

Oriental region. For those seeking clues to the derivation of our fauna, it gives a lead with much corroboration from other examples. It does not tell us very much about mode or modes of dispersal, although the fact that these insects are fairly sturdy and large would indicate probability of wind carriage. Another favorable circumstance is their record of multiple rather than single host attachment. There is also the possibility of their being carried in drift or being transferred with host material in economic plants by human agency. An interesting fact about the genus is that several of the species are among the earliest described Pacific insects. Sir Joseph Banks accompanied Captain Cook on his first voyage in 1768-71 in the south Pacific (Tahiti, New Zealand, Australia, and the Dutch East Indies). Most of Banks' insect collecting was done while the ship *Endeavor* was stranded and laid up for repairs for four months near the present site of Cooktown, New Zealand. Banks was not with Captain Cook on the voyage in which he discovered the Hawaiian islands in 1778, but it is believed that when the ship was lying at anchor off Kauai near the mouth of the Waimea River, some insects were collected which eventually went into the Banksian collection deposited in the British Museum, as Hawaiian species were described from this collection only a few years later.

NEW SEISMOGRAPHS FOR MAUNA LOA

By

T. A. Jaggar

The Mauna Loa campaign is the aim of 1937 for Hawaiian Volcano Observatory. The Jaggar shock-recorder is a basis for a new design. This is a flexible, small three-compartment instrument fourteen inches square, ten inches high, with three-pound iron bars encased in wood for pendulum weights. It is flexible in the sense that it can be modified for special quests. The suspensions are upright flat steel, clamped for flexure as hinges, length determining period, the system an inverted pendulum for the horizontal components. The same system for vertical component is clamped horizontally, giving equivalent constants. All register on a single clock dial, which rotates and keeps time. The dial is covered with smoked, translucent paper. The smoking is wholesale and the sheets are packed ready-smoked in special containers and returned in the same to headquarters. Every part of the seismograph is detachable and cheap.

A special quest is a pen that will arrest electrically the first excursion of P, and lock off the rest of a seismogram. The object is to get this amplitude

and direction for about twenty-five instruments covering a measured ground pattern. The object of all the new models is geographical and automatic. Some will be run by ranches, schools, or telephone stations. No burdens beyond what would lie in a thermograph are contemplated. Others will be in ground cavities visited by automobile. The underlying theory of the effort is to cover an area for getting uniform empirical data about a volcanic center known to be periodically critical.

AN AGGRESSIVE LANTANA MUTATION

By

F. R. Fosberg

A mutation of the common *Lantana Camara* L. was noticed as a small patch in 1933 on Manoa-Palolo ridge, Oahu. A year later it was noticed on Palolo-Waialaenui ridge. It has since spread until it now covers large areas in Manoa and Palolo valleys. A similar mutation was noticed between Hilo and Kilauea, Hawaii, in 1933, but it has evidently not spread.

The Oahu mutation is characterized by having the corolla white with a yellow tube, the white portion turning pale pink with age. The stems seem always more prickly.

It seems to be replacing the normal form at a rapid rate. Suggested reasons for this are: greater shade tolerance, greater seed production, and greater resistance to parasites. It may spread so as to cause *Lantana* to become a worse pest in the future.

An opportunity is thus presented for study of the rate of change in populations of plants, which may lead to facts of some evolutionary significance.

It seems well to point out the desirability of recording this and other such apparently insignificant beginnings of phenomena when observed, for the benefit of those who may be interested in the problems to which they lead in the future.

THE DIAMOND HEAD BLACK ASH

By

CHESTER K. WENTWORTH

Black ash, or cinders from explosive volcanic eruptions, form conspicuous surficial deposits in the Tantalus, Makiki, and other parts of Honolulu. The fine-grained black sand deposits southeast of Diamond Head and along the Black Point Coast have long been considered to be true black ash of explosive origin. Recently the Diamond Head material has been described as the product of wave action on coastal rocks, drifted inland by the wind to form dunes, hence a sand rather than a true ash formed by explosion. In order to determine which of these views is correct, I have repeated and extended earlier field and microscopic examination of the material in question. The result is a complete substantiation of the original view. About 98 percent of the fragments are glass, in vesicular, pulled, droplet forms, with delicate, unbroken points, and with no sign of abrasion. Structure, bedding, and distribution, as well as the composition, all strongly indicate formation by volcanic explosion, with but a minor part indicating some contemporaneous movement by the wind. Final proof of the volcanic interpretation is afforded by a one-inch layer of volcanic pisolites, or accretionary lapilli, which have been traced in the formation some five hundred feet along the Black Point coast. These pisolites are tiny mud balls about a half millimeter in diameter which were formed around raindrops which fell through the dust-laden air during a brief shower which accompanied the eruption. Such pisolites are well known at Kilauea, and their formation has been observed by many geologists. The black ash beds lie on a reef conglomerate containing rounded boulders derived from the earlier Black Point lava flow, and hence are the product of a second Black Point eruption. The explosive phase was probably induced when the molten lava entered the sea, the explosive eruption of the littoral type, like that which formed Puu Hou near Kalae, Hawaii, in 1868. It evidently took place when the sea stood no higher than at present and was much the most recent volcanic event in the Diamond Head area.

(Listed for publication in the Journal of Sedimentary Petrology.)

TRENDS IN THE PHILOSOPHY OF SCIENCE

By

T. A. JAGGAR

(Hawaiian Volcano Observatory, Volcano Letter 447.)

How has science changed in a century? What is the definition of its present motives? It may be divided under:

1. Language, the chief promoter of science.
2. Experiment, the chief activity of science.
3. Reform, the chief goal of science.
4. The Earth, the chief subject of science.

Science deals with Nature: natural origins, progress and future of universe, earth, energy and life. Forecast of the future is the supreme test of success, predicting that under like conditions like results will ensue. The three fundamental concepts are uniformity, evolution, and value. With uniformity go symmetry and rhythm, all in Nature herself. With value goes number, both probably human. Evolution is a function of space-time, a human concept.

Language carries with it logic and mathematics. Language is supreme in thought and reasoning, is imperfect, and contains the history of all scholarship.

Experiment has grown so that all sciences have changed to experimental specialties. Geology changes to geophysics, botany and zoology to biometry, and so forth. The old physics of the nineteenth century was not complacent, but was progressive with great names. So with biology, medicine and astronomy.

Reform has been disguised as research. The real aim of science has grown to be extrovert. It needs to grow more responsible for extroversion of society.

The Earth is necessarily the chief subject of science for out of it comes civilization and man. Philosophical ultimates are not realities for man. Man is spreading out, and room for him will be made by the conquest of congestion through achievement of distribution; and science will discover materials and power, and invent extrovert education.

SOME ACCOMPLISHMENTS ARISING FROM RESEARCH FINANCED BY SUGAR PROCESSING TAXES

By

OSCAR C. MAGISTAD

Seven projects approved by the Agricultural Adjustment Administration to be financed by sugar processing taxes were assigned to the Hawaii Agricultural Experiment Station in the fall of 1935. A few of the accomplishments which have been achieved as a result of these projects are given below.

POULTRY

A disease of poultry rapidly spreading in 1935 and caused by gizzard worms was discussed. The life cycle and intermediate hosts of this worm have been established and control methods and methods of sanitation recommended. The intermediate hosts are grasshoppers, sand shrimps, and about ten varieties of beetles. The gizzard worm disease is now receding in the Territory and is no longer a terror to poultrymen. Research dealing with other parasitic diseases, such as the eye-worm, the proventricular worm, and intestinal worm was touched upon.

The work going on in cross-breeding to develop more meaty birds which are at the same time good egg layers was explained. With our relatively high prices for broilers and poultry meat this side of the picture needs to be emphasized.

Poultry rations containing mainly locally grown foods are under investigation and one can be recommended as an emergency ration. It will maintain body weight and egg production fairly well for a limited period of 5-6 months or more.

LIVESTOCK FEEDS

The great importance of our livestock industry and the research being done in this field were discussed. This includes pasture investigations, fattening trials, meat tests, and digestibility determinations of many local feeds. As regards swine, local feeds are being tried out, some of them with great success.

STUDIES OF THE CAUSES OF SEEDINESS IN THE CAYENNE PINEAPPLE

By

J. L. COLLINS AND K. R. KERNS

The Cayenne variety of pineapple is seedless due to the failure of the pollen tubes to grow more than one-sixth the length of the pistil. This condition of self-incompatibility probably arose in one or more mutations from the normal seedy condition. Feral pineapples produce seeds while the majority of cultivated ones do not.

In the regularly seedless Cayenne variety occasional seedy fruits are found. Records made at the cannery over a period of twelve years show a gradual increase in the percentage of seedy fruits with a marked decrease in 1933 and 1934. During the years 1935 and 1936 the percentage of seedy fruits had again increased until it had reached the high peak of 1931 and 1932. The lower percentage for 1933 and 1934 may be directly correlated with the discarding of large quantities of planting materials from certain areas in 1931 and 1932.

In addition to these two features, the cannery data on percentage of seedy fruits revealed a regular annual fluctuation in the percentage of seedy fruits. Plants which were in blossom during the summer months produced approximately twice as many seedy fruits as did plants which blossomed during the winter months. This annual variation appears to be associated with temperature and sunshine for the corresponding periods.

Clons, which regularly produce seedy fruits, have been established from single plants producing seedy fruits. These clons differ in regard to kind and quantity of seeds produced. Some produce few, others many seeds; while others produce only abortive seeds. The pollen from seedy clons will cause seed to form in normal Cayenne plants. The seedy clons arose as dominant mutation in the normal seedless Cayenne variety and represent a reversion to the wild, ancestral pineapple.

Appropriate tests have shown that seeds in these clons are the result of self-fertilization and not due to parthenogenetic development of the egg cells. Self-pollination of the normal Cayenne does not cause seed development.

In this problem of seediness we thus have a genetic basis for self-fertilization, and superimposed upon it a fluctuating environment which exerts a favorable or unfavorable influence on seed development.

(Presented by Mr. Kerns. Illustrated with slides and charts.)

PARASITISM IN HAWAII

By

NILS P. LARSEN

Analysis of parasites as found in Hawaii was given in a series of tables showing the low incidence for people in Honolulu, and a higher incidence for people on the plantations. However, the various studies indicate that the amount of intestinal parasitism is less than popular belief has it.

The difference between infestation in small quantities in intestines of people coming here, and true infestation producing disease, was indicated.

A series of slides was also presented, showing the common types of intestinal parasites found here. The study covered series done in laboratories on Maui, Kauai, and Oahu. Dr. Wilbar's work at the Ewa Health Center, in an attempt to eradicate parasites, shows that this is a feasible proposition.

THE USE OF THE ARC SPECTRUM IN QUALITATIVE ANALYSIS

By

STANLEY S. BALLARD, PAUL E. CHU, AND PAUL L. GOW

An improved technic of qualitative chemical analysis by use of the arc spectrum has been developed. Many features of the technic were taken from the standard methods described in scientific books and journals, but some features were necessarily developed by us when the standard methods were found to be unsatisfactory, inapplicable or incorrect. Our procedure consists of burning a sample of the specimen in an arc run at five to seven amperes and of photographing the spectrum of the light from the arc with a quartz spectrograph. The photographic plate is then studied, and the presence or absence in the sample of some fifty elements can be established. We have taken elaborate precautions to prevent any contamination of the sample or of the electrodes. Electrodes of iron, carbon, and copper of the highest obtainable purity are used. Specially developed methods of cleaning and shaping the electrodes preserve their purity as much as is possible. A spectrum of the bare electrodes is photographed on each plate so that the presence of any impurities will be detected immediately. Samples of the specimen to be analyzed are ground in an agate mortar and weighed out into ten milligram portions. One of these portions is placed in a pit in the lower arc electrode by using a glass sleeve and small funnel arrangement devised by us. This method of introducing samples into the arc avoids the danger of contami-

nation that is always present in the standard method of compressing the sample into a pellet. The spectrum taken with a weighed amount of sample placed in the arc permits a quasi-quantitative estimate of its composition to be made, while a second spectrum taken using a much larger specimen shows spectrum lines due to the smallest traces of elemental constituents.

AN ALGEBRA OF APPROXIMATIONS

By

ELVIN A. HOY

Definition 1: An approximation has *n* significant figures if the maximum error is numerically less than one-half a unit in the *n*th figure. For example, 16.50 has four significant figures with an allowable error of $\pm$ 0.005 while 18 has two significant figures with an allowable error of $\pm$ 0.5.

Zeros are not always significant and may be just fillers to the decimal point. Examples:

93,000,000 miles to the sun has only two significant figures and six non-significant zeros.

Charge on electron, 1.59×10^{-19} coulomb has 3 significant figures and 18 non-significant zeros.

Rule 1: To round off a decimal fraction:

(a) Drop, if it is less than one-half unit of the preceding digit.
(b) Increase preceding digit by one if greater than one-half unit.
(c) If exactly one-half unit, drop if preceding digit is even but add a unit to the preceding digit if odd.

Examples: (a) $18.32 = 18$; (b) $17.831 = 18$;
(c) $18.5 = 18$; $17.5 = 18$.

Thus each approximation represents an infinite set of rounded numbers.

Rule 2: (a) In addition or subtraction retain as significant figures in the sum or difference only to that uncertain figure occurring farthest to the left relative to the decimal point.

Ex. 1: $16.50 + 21.50 + 14.50 + 19.50 + 22.50 + 17.50 + 18 = 130. = 1.30 \times 10^2$

Ex. 2: $702.350 - 17.2 = 685.2$

(b) If there are *n* terms with uncertain end figures occurring at the same point farthest to the left relative to the decimal point, then the maximum error in the last figure of the sum may be $n/2$ units.

Ex. $16.4 + 21.6 + 14.2 + 19.8 - 22.0 - 17.2 = 32.8 \pm .3 = 33$

Rule 3: In multiplication, division, and powers, if the least accurate factor has n significant figures, the result has n or n-1 significant figures.

Ex. 1: $24.086 \times 320. = 7{,}710 \pm 12 = 7.7 \times 10^3$

Ex. 2: $460.50/2.10 = 219 \pm 0.52 = 2.19 \times 10^2$

Ex. 3: $(9.8)^3 = 940 \pm 14 = 9 \times 10^2$

Rule 4: If an approximation has n significant figures, its rth root has at least n significant figures.

Ex. $\sqrt{752.40} = 27.430$

since $\sqrt{752.395} = 27.42982$ or 27.430

and $\sqrt{752.405} = 27.43000$ or 27.430

Rule 5: In any combination of operations, observe the above rules in each part of the computation. In combinations between approximations and exact numbers the number of significant figures of the result depends only on the accuracy of the approximations.

Ex. $(1.276 \times 0.00056) - (1.2 \times 10^{-3}) - (0.0023456 \times 0.0128) = -0.0005 = -5 \times 10^{-4}$.

Rule 6: In a final published constant, whose probable error is included, retain no figures beyond the position of the first significant figure in one-half the probable error; keep two more places in all computations.

Ex. 1: Mean $= 2.201 \pm .016$ gm.

Ex. 2: Standard Deviation $= 0.287 \pm .011$ gm.

Ex. 3: Coefficient of Correlation $= 0.827 \pm .014$.

SOME MODERN ASPECTS OF ENZYME CATALYSIS

By

A. K. Balls

Enzymes are simply catalytic agents elaborated within the living cell, but they do not require the presence of living cells to perform their work. The reactions accelerated by enzymes are of two groups: reactions of hydrolysis and reactions of oxidation. Hydrolysis is essentially a process of breaking-down, oxidation results in movement, growth, building-up. Several of the enzymes have been crystallized. They consist of an active or functional group attached to a much larger colloidal particle or carrier. In catalysing reactions the active group of the enzyme combines with a particular characteristic group in the substrate. We thus have the phenomenon of enzymic specificity.

It has recently become evident that besides the presence of the characteristic group in the substrate, other factors may be involved in enzymic specificity. The characteristic group of the substrate may be shielded by surrounding groups thus preventing a combination between the substrate and enzyme, or the temperature might be too low as was found in the case of some of the fat-splitting enzymes.

Many enzymes occur in an inactive form and have to be activated before they will work, such is the case with papain and bromelin. The inactive form is the oxidized form and on reduction they become active. Such substances as hydrogen sulphide, sodium sulphite, cysteine, and hydrocyanic acid act as reducing agents.

Many of the enzymes seem to be able to reproduce themselves, that is, they appear to be alive, but actually it is a change from the inactive to the active form.

Enzymes have long been important laboratory reagents, and are now finding their way into industry. They are used in the fermentation industries, in the manufacture of cheese, in the tanning of leather, in the dyeing of cotton cloth, in soap making, in the chill-proofing of beer, and in medicine.

The enzymes as products of the living cell are agricultural products. If we are unmindful of them, they are the cause of spoilage, decay, putrefaction. If we handle them wisely and use them to advantage, they are chemical reagents that can revolutionize the industry of agriculture. I give you the enzymes.

AMENDMENTS TO THE CONSTITUTION

DECEMBER 4, 1936

Toward the end of simplifying the membership rolls of the Academy, the Council presented the following amendments to the Constitution:

(1) Delete Article III, Section 1, and Article III, Section 3.

(2) Rewrite the remaining section to read:

Article III, Membership

Any resident of the Territory of Hawaii interested in Science shall be eligible for election as a member. There shall be one grade of membership only.

(3) Article IV, Section 5. Delete the words "in either class." The section will then read: "Election to membership shall require a favorable vote from three-fourths (¾) of the members present."

(4) Article X, Section 1. Delete the words "Corresponding members shall pay no dues."

In order that the fall meetings of the Academy may have sufficient constitutional status to permit the transaction of business, the following amendments to the Constitution are recommended by your Council:

(1) Rewrite Article VIII, Section 1, to read:

Article VIII, Meetings

1. The Academy shall hold a stated meeting in April or May of each year, to be known as the Final Session of the Annual Meeting. It shall hold such other scheduled sessions for the presentation of papers and the transaction of business as the Council deems fitting, such sessions to be known as the First Session, Second Session, and the like, of the Annual Meeting in question.

Any session for the presentation of papers shall be announced by a preliminary circular at least six weeks before the date scheduled for the meeting, calling for papers for the program. Final announcement, giving dates and place of meeting, shall be sent out at least two weeks prior to each such session. The program, place and dates shall be determined by the Council.

(2) Rewrite Article IV, Section 1, to read:

Article IV, Nomination and Election of Members

1. Nomination to membership shall be made in writing to the Council at least two weeks before any scheduled session. Each nomination must be signed by three members of the Academy.

(3) Delete Article IV, Section 4.

(4) Renumber the present Section 4, Article IV, as Section 3, Article IV.

The above amendments to the constitution were carried by the majority and a motion passed that the amendments be incorporated into the Constitution.

MEMBERS

HONOLULU

Adams, Romanzo
Agee, H. P.
Aitken, R. T.
Akau, G. H.
Alicata, J. E.
Allen, Oscar N.
Anderson, Donald
Andrew, K. L.
Andrew, Nancy
Andrews, Carl B.
Arnold, H. L.

Baker, K. F.
Baker, Ray J.
Ballard, Stanley S.
Barnhart, Geo. H. W.
Beaglehole, Ernest
Bean, Ross S.
Beaumont, J. H.
Bianchi, Fred A.
Bilger, Earl M.
Bilger, Leonora N.
Borden, R. J.
Bowles, Herbert
Britton, John
Brown, E. D. W.
Brown, F. B. H.
Brugger, Florence
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Buck, Peter H.
Budin, Olga Fulton
Bull, Edythe
Burmeister, E. R.
Burrows, Edwin G.
Bush, William

Cady, H. B.
Campbell, Edward L.
Carpenter, C. W.
Carson, Max H.
Carter, Walter
Cartwright, Bruce
Catto, Robert J.
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Chapman, Royal N.
Chun, Edwin Y.
Chung, Mon Fah
Clark, Harold
Clark, William O.
Collins, George M.
Collins, J. L.
Cooke, C. M.
Cooke, Douglas A.
Cooke, Richard A.
Coulter, John Wesley
Crawford, D. L.
Curtis, Walter L.

Das, U. K.
Davis, Lannes E.
Dean, A. L.
Dean, Lyman A.
Denison, Harry L.
Devereaux, John W.
Dillingham, F. T.
Donaghho, J. S.
Doty, R. E.

Edmondson, C. H.
Egler, Frank E.
Eguchi, George
Ehrhorn, E. M.
Eller, Willard H.
Emory, Kenneth P.
Erwin, Ada B.

Fabius, Albert
Farden, Carl A.
Faus, R. B.
Fennel, E. A.
Ferguson, George E.
Field, Harry P.
Ford, A. H.
Fosberg, F. R.
Foster, Z. C.
Fronk, C. E.
Fujimoto, Giichi
Fullaway, D. T.

Giesen, Elizabeth
Gilbert, James
Gordon, Golda Hyde
Gordon, Maurice
Gotschalk, H. C.
Gow, Paul
Gregory, H. E.

Hadden, F. C.
Hammond, W. H.
Hamre, Christopher J.
Hance, F. E.
Harry, John V.
Hartt, Constance E.
Henke, Louis M.
Holmes, Henry
Holmes, W. G.
Hosaka, Edward Y.
Hoy, Elvin A.
Hutchinson, A.E.

Illingworth, J. E.
Ingram, William M.
Ito, Kiyoshi

Johnson, Horace
Jones, Austin E.
Jones, Stephen B.
Judd, Albert F.
Judd, Chas. S.

Katsuki, I.
Keller, A. R.
King, Norman
King, Robert D.
Koehler, Lucy J.
Krauss, Beatrice H.
Krauss, F. G.
Krauss, W. W.
Kunesh, Joseph F.

Lam, Margaret
Lam, Robert L.
Lamb, Alvin R.
Larrabee, L. M.
Larsen, N. P.
Lee, Robert
Lennox, Colin G.
Lessa, William A.
Ley, Gaston J.
Libbey, Valentine
Lind, Andrew W.
Linford, Maurice B.
Livesay, T. M.
Loomis, Chas. F.
Louis, James L.
Lyon, Maude F.
Lyon, H. L.

MacNeil, W. J.
MacVeagh, Thomas C.
Magistad, O. C.
Mangelsdorf, A. J.
Mason, Arthur C.
McAllep, Will R.

McBride, O. C.
McKay, William
McGuire, Thos. R. L.
Meinecke, Joseph B.
Meinecke, William H.
Metraux, Alfred
Meyer, H. A.
Millard, Robert
Miller, C. D.
Miller, Milton A.
Mirikitani, Clifford
Mitchell, Donald
Moltzau, Ralph H.
Morgan, Edward
Moss, L. C.
Munro, George C.

Nakamoto, G.
Neal, Marie C.
Nelson, Frances
Nightingale, G. T.
Nikaido, Raymond
Northwood, J. d'A.

Okimoto, Marion C.
Oliveira, Juliette M.
Olson, Gustaf W.
Ostergaard, Jens

Palmer, H. S.
Parris, G. Keith
Payne, J. H.
Pemberton, C. E.
Phillips, L. G.
Pinkerton, F. J.

Ripperton, J. C.
Robbins, Ruth
Rols, Edwin E.

Sakimura, Kay
Satterthwaite, Ann Y.
Schmidt, Carl T.
Shepard, Oscar F.
Sideris, C. P.
Sinclair, Gregg M.
Slattery, Mabel
Smith, Leslie R.
Smith, Madorah E.
Smith, Ronald Q.
Spalding, P. E.
Spiegelberg, Carl H.
St. John, Harold
Stokes, J. F. G.
Storey, William
Street, Alison Watt
Suehiro, Amy
Suzuki, Francis T.
Swezey, O. H.

Takahashi, Tokue
Tam, Richard K.
Thomas, A. R.
Tinker, Spencer
Titcomb, Margaret
Topping, D. LeRoy

Usinger, Robert L.

Van Zwaluwenburg, R. H.
Vernon, Mabel D.
Voorhees, George

Wadsworth, Harold A.
Wakabayashi, S.
Weidman, Arah
Weinrich, William
Welch, d'Alté A.
Welch, J. E.
Weller, D. M.
Wentworth, Chester K.
Wentworth, Edna C.
Westervelt, W. D.
Westgate, J. M.
Westgate, Mark
Wheeler, Mary
Whitney, Leo
Wicke, Henry
Willard, H. F.
Williams, F. X.
Williams, Frances
Williams, John N. S.
Wilsie, C. P.
Winstedt, Ruth M.
Withington, Paul
Work, Samuel H.

Yang, Y. C.
Yap, Ruth
Young, H. Y.

Zimmerman, E. C.

Rural Oahu

Atherton, Ballard

Budin, Harry M.

Cooper, Lucy V.
Cooper, Will J.

Davis, A. L.
Degener, Otto

Gantt, Paul A.

Kerns, Kenneth R.

Renton, George F.

Thompson, Henry O.

Wilbar, Chas.

Other Islands

Bond, K. D.
Bryan, L. W.

Dickey, Lyle A.

Elbert, Samuel H.

Giacometti, G.

Jaggar, T. A.

Lamb, Sam

Stearns, Harold T.

Waesche, Hugh H.
Webster, James N. P.
Wingate, E. G.

Mainland

Davis, Watson

Handy, E. S. C.
Louttit, C. M.

Wilder, Helen C.